

## REMARKS

By the present amendment, claims 1, 25, 48 and 105 have been amended, claims 17 and 40 have been cancelled, and new claims 121-122 have been added. Accordingly, claims 1-16, 18-39 and 41-122 are presently pending, and favorable reconsideration thereof is respectfully requested. Claims 1, 25, 48, 50, 54, 76, 100, 105 and 121 are the independent claims. Claims 66, 71, 89, 90, 96, 117, 119 and 120 have been withdrawn from consideration. Applicant has also amended the Abstract as suggested by the Examiner.

Applicant wishes to thank the Examiner for the careful review of the present application and the prior art, and for the indication that dependent claims 55-58, 77-80 and 101-103 recite allowable subject-matter.

### **Abstract**

The Examiner has objected to lines 1 and 6 of the Abstract on the ground that line 1 repeats information given in the title, and lines 1 and 6 contain implied phrases.

By the present amendment, the Abstract has been amended to delete the passages to which the Examiner objected. Applicant therefore respectfully submits that this ground of objection is overcome.

### **35 U.S.C. § 103(a), claims 1-22, 24-43, 45-49, 50-54, 59-65, 72-76, 81-88, 93-94, 97-100, 104-116 and 118**

The Examiner has expressed the view that claims 1-22, 24-43, 45-49, 50-54, 59-65, 72-76, 81-88, 93-94, 97-100, 104-116 and 118 are unpatentable over U.S. Patent No. 5,219,786 to Noguchi ("Noguchi"), in view of U.S. Patent No. 5,561,735 to Camm ("Camm"), and further in view of U.S. Patent No. 5,960,158 to Gat et al. ("Gat").

Applicant respectfully submits that the Noguchi, Camm and Gat references fail to support a *prima facie* case of obviousness in relation to the above-listed

claims. In this regard, the requirements for a *prima facie* case of obviousness have been well established by the Court of Appeals for the Federal Circuit, and are concisely summarized in M.P.E.P. § 2142 and 2143, which confirm that three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Applicant respectfully submits that at least the third of the above requirements is not satisfied in relation to amended independent claim 1, as the proposed combination of references fails to disclose at least some of the limitations of claim 1.

By the present amendment, independent claim 1 has been amended to recite a method of heat-treating a workpiece, the method comprising:

- a) pre-heating the workpiece to an intermediate temperature;
- b) heating an entire surface of the workpiece to a desired temperature greater than the intermediate temperature, within a time period less than a thermal conduction time of the workpiece; and
- c) enhancing cooling of the workpiece.

Noguchi discloses a semiconductor layer annealing method using an excimer laser. A wafer 1 includes a glass substrate 2, a SiO<sub>2</sub> buffer layer 3, and a polycrystalline silicon layer 4. The wafer 1 is heated at 600°C by an arc lamp

5, and then the polycrystalline silicon layer 4 is irradiated with a pulse excimer laser beam. As shown in Figure 1C, a trigger signal is given to the excimer laser to actuate the excimer laser when the wafer 1 is heated at 600°C by the arc lamp 5. (Noguchi, col. 2, lines 31-36, col. 2 line 66 – col. 3 line 7, and Fig. 1C).

In order to irradiate a surface of the polycrystalline layer 4, Noguchi discloses that “A pulse excimer laser beam projected by the excimer laser from under the wafer 1 falls on the semiconductor silicon layer 4 to heat a portion of the polycrystalline silicon layer 4 of a predetermined small area at a time. The position of incidence of the pulse excimer laser beam is shifted gradually to irradiate the entire area of the polycrystalline silicon layer 4.” Fig. 1C of Noguchi appears to indicate that this gradual beam-shifting process takes 3 to 10 seconds to irradiate an entire side of the polycrystalline layer. (Noguchi, col. 2, lines 59-65, and Fig. 1C). The Examiner will appreciate that this period of time is significantly greater than the thermal conduction time of the wafer 1 of Noguchi (for example, by way of comparison, Applicant’s specification at page 40, line 10 and page 41, lines 14 and 21-22 describes a thermal conduction time of 10 to 15 milliseconds for a typical silicon semiconductor wafer).

Thus, Noguchi fails to disclose or suggest “heating an entire surface of the workpiece to a desired temperature greater than the intermediate temperature, within a time period less than a thermal conduction time of the workpiece”, as recited in amended claim 1.

Similarly, neither Camm nor Gat disclose or suggest these limitations, nor has the Examiner suggested that they are disclosed in either of the latter two references.

Accordingly, the proposed combination of references fails to disclose or suggest “heating an entire surface of the workpiece to a desired temperature greater than the intermediate temperature, within a time period less than a

thermal conduction time of the workpiece", as recited in amended claim 1. Therefore, at least the third of the above requirements for a *prima facie* case of obviousness is not satisfied. Applicant therefore respectfully submits that a *prima facie* case of obviousness is not established in relation to amended claim 1, and respectfully requests that the rejection of claim 1 be withdrawn.

Claims 2-16, 18-22 and 24 are directly or indirectly dependent upon claim 1. Applicant therefore respectfully submits that these claims are allowable due to their dependencies, as well as the additional subject-matter that each of these claims recites.

Claim 17 has been cancelled, and therefore, the rejection of this claim is overcome.

By the present amendment, independent claim 25 has been amended to recite a system for heat-treating a workpiece, the system comprising:

- a) a pre-heating device operable to pre-heat the workpiece to an intermediate temperature;
- b) a heating device operable to heat an entire surface of the workpiece to a desired temperature greater than the intermediate temperature, within a time period less than a thermal conduction time of the workpiece; and
- c) a cooling enhancement system for enhancing cooling of the workpiece to a temperature below the intermediate temperature.

Applicant respectfully submits that a *prima facie* case of obviousness is not established in relation to amended claim 25, for reasons including those presented above in connection with claim 1.

Claims 26-39, 41-43 and 45-47 are directly or indirectly dependent upon claim 25. Applicant therefore respectfully submits that these claims are allowable due to their dependencies, as well as the additional subject-matter that each of these claims recites.

Claim 40 has been cancelled, and therefore, the rejection of this claim is overcome.

By the present amendment, independent claim 48 has been amended to recite a system for heat-treating a workpiece, the system comprising:

- a) means for pre-heating the workpiece to an intermediate temperature;
- b) means for heating an entire surface of the workpiece to a desired temperature greater than the intermediate temperature, within a time period less than a thermal conduction time of the workpiece; and
- c) means for enhancing cooling of the workpiece.

Applicant respectfully submits that a *prima facie* case of obviousness is not established in relation to amended claim 48, for reasons including those presented above in connection with claim 1.

Claim 49 is dependent upon claim 48. Applicant therefore respectfully submits that this claim is allowable due to its dependency, as well as the additional subject-matter that it recites.

Independent claim 50 recites a selective-filtering system for use in heat-treating a workpiece, the system comprising:

- a) a first filtering device configured to transmit radiation from a pre-heating device to the workpiece to pre-heat the workpiece to an intermediate temperature, and configured to absorb radiation thermally emitted by the workpiece; and
- b) a second filtering device configured to transmit radiation from a heating device to a surface of the workpiece to heat the surface to a desired temperature greater than the intermediate temperature, and configured to absorb radiation thermally emitted by the workpiece.

The Examiner has conceded that Noguchi does not disclose enhancing cooling of the workpiece by absorbing radiation reflected and thermally emitted by the workpiece.

Camm discloses a rapid thermal processing apparatus and method. An apparatus 10 includes a chamber 20 having first, second and third walls 22, 24 and 26. The walls 22, 24 and 26 have respective radiation absorbing surfaces 36, 38 and 40 for absorbing radiation incident thereon, and may be water cooled using conventional methods (col. 5, lines 1-22). However, Camm fails to disclose first and second filtering devices, configured to transmit radiation from a pre-heating device and from a heating device to the workpiece respectively, and configured to absorb radiation thermally emitted by the workpiece, as recited in claim 50.

Gat discloses an apparatus and method for filtering light in a thermal processing chamber 12. A light source 22 including a plurality of lamps 24 is placed above a wafer 14. A first spectral filter 32 and a second spectral filter 34 are spaced apart from each other and are positioned between the light source 22 and a radiation sensing device 30, and serve to substantially prevent thermal radiation from the lamps 24 at the wavelength at which the radiation sensing device 30 operates from entering the chamber 12. A cooling fluid channel 36 is defined between the filters 32 and 34, and is designed to allow a cooling fluid to circulate between the filters. The first

spectral filter 32 is designed to substantially absorb most of the thermal radiation emitted by the light source 22 at the wavelength at which the radiation sensing device 30 operates. The second spectral filter 34 is substantially transparent to thermal radiation at this same wavelength. (See e.g. col. 7, lines 14-21 and 54-60; col. 8 lines 7-11 and 34-39; col. 9 lines 7-11; and Fig. 1 of Gat.)

Gat further discloses that "Preferably, [the] second spectral filter 34 should also be transparent to most thermal radiation at any wavelength being emitted by [the] wafer 14 in order to keep [the] spectral filter 34 from increasing in temperature." (Col. 9, lines 7-11).

Thus, Gat fails to disclose or suggest "a first filtering device configured to transmit radiation from a pre-heating device to the workpiece to pre-heat the workpiece to an intermediate temperature, and configured to absorb radiation thermally emitted by the workpiece" and "a second filtering device configured to transmit radiation from a heating device to a surface of the workpiece to heat the surface to a desired temperature greater than the intermediate temperature, and configured to absorb radiation thermally emitted by the workpiece", as recited in claim 50. Moreover, the above-cited passage of Gat at col. 9, lines 7-11 appears to teach away from these limitations.

Accordingly, the proposed combination of references fails to disclose at least some limitations of claim 50, and therefore, at least the third requirement for a *prima facie* case of obviousness is not satisfied. In addition, as Gat appears to teach away from the subject-matter recited in claim 50, there is no suggestion or motivation to combine or modify the references as suggested by the Examiner, and therefore, the first requirement for a *prima facie* case of obviousness is not satisfied. Applicant therefore respectfully submits that a *prima facie* case of obviousness is not established in relation to independent claim 50, and respectfully requests that the rejection of claim 50 be withdrawn.

Claims 51-53 are directly or indirectly dependent upon claim 50. Applicant therefore respectfully submits that these claims are allowable due to their dependencies, as well as the additional subject-matter that each of these claims recites.

Independent claim 54 recites a method of heat-treating a workpiece, the method comprising:

- a) pre-heating the workpiece to an intermediate temperature; and
- b) heating a surface of the workpiece to a desired temperature greater than the intermediate temperature, said heating commencing substantially immediately when the workpiece reaches the intermediate temperature.

The Examiner has stated that "Although Noguchi doesn't explicitly state that heating is started once the workpiece has reached the intermediate temperature, it is inherent". The Examiner does not appear to have suggested that the Camm or Gat references are relevant to claim 54.

Applicant respectfully submits that the Noguchi reference fails to satisfy the requirements for a finding of inherent disclosure of "said heating commencing substantially immediately when the workpiece reaches the intermediate temperature", as recited in claim 54.

In this regard, the requirements for a finding of inherency are concisely summarized in M.P.E.P. § 2112, as follows:

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (reversed rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art); *In re Oelrich*, 666 F.2d 578,



581-82, 212 USPQ 323, 326 (CCPA 1981). "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.' " *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) [emphasis added]

Noguchi states, "As shown in Fig. 1C, a trigger signal is given to the excimer laser to actuate the excimer laser when the wafer 1 is heated at 600°C by the arc lamp 5." However, Noguchi fails to disclose that the trigger signal is generated immediately or "substantially immediately when the workpiece reaches the intermediate temperature", as recited in claim 54. Rather, visual inspection of Fig. 1C suggests that there is at least some delay following the arrival of the wafer 1 at the intermediate temperature of 600°C before the trigger signal is generated.

Applicant further respectfully notes that in the context of the Noguchi reference, Noguchi does not appear to suggest any need for or desirability of commencing the excimer laser irradiance stage immediately after the wafer 1 has arrived at the intermediate temperature. Noguchi appears to be concerned only with ensuring that the intermediate temperature does not exceed a critical upper limit, namely, the softening point of 600°C of the low-melting glass substrate 2 of the wafer 1. (Noguchi, col. 3, lines 17-23; see also col. 2, lines 32-33; col. 3 lines 61-66; and col. 4 lines 26-27 and 61-62.) Noguchi does not appear to be concerned with reducing or minimizing the time spent at the intermediate temperature, and indeed, Figure 1C appears to indicate that the wafer 1 is held at the intermediate temperature for a relatively long period of time, namely, 3 to 10 seconds, while the pulse excimer laser beam gradually scans across the polycrystalline silicon layer 4. Thus, in view of this relatively long period during which the wafer 1 is sustained at the intermediate temperature, there would be no appreciable

advantage to commencing the pulse excimer laser beam scanning stage “substantially immediately” when the wafer 1 reaches the intermediate temperature of 600°C. More generally, Noguchi failed to appreciate that any disadvantages may flow from prolonging the duration at which the wafer 1 is sustained at the intermediate temperature. In this regard, Applicant respectfully notes that Noguchi was filed in 1992, at which time typical semiconductor devices were not sensitive to such prolonged durations at such intermediate temperatures. (In contrast, as noted in Applicant’s specification at page 10, lines 1-9, page 13, lines 19-29 and page 41 lines 3-25, for example, the present inventors have appreciated that as a result of present and future device size and performance demands, it is desirable to minimize the time that the workpiece spends at the intermediate temperature, to minimize undesirable dopant diffusion.)

Thus, in view of the above passages of Noguchi, it cannot be said that Noguchi necessarily discloses “said heating commencing substantially immediately when the workpiece reaches the intermediate temperature”, as recited in claim 54. Therefore, the Noguchi reference fails to satisfy the above-noted requirements for a finding of inherent disclosure of these limitations. Accordingly, the proposed combination of references fails to disclose at least some of the limitations of claim 54, and therefore, at least the third of the above-noted requirements for a *prima facie* case of obviousness is not satisfied. Applicant therefore respectfully submits that a *prima facie* case of obviousness is not established in relation to independent claim 54, and respectfully requests that the rejection of claim 54 be withdrawn.

Claims 59-65, 69 and 72-75 are directly or indirectly dependent upon claim 54. Applicant therefore respectfully submits that these claims are allowable due to their dependencies, as well as the additional subject-matter that each of these claims recites.

Independent claim 76 recites a system for heat-treating a workpiece, the system comprising:

- a) a pre-heating device operable to pre-heat the workpiece to an intermediate temperature; and
- b) a heating device operable to heat a surface of the workpiece to a desired temperature greater than the intermediate temperature, and operable to commence the heating of the surface substantially immediately when the workpiece reaches the intermediate temperature.

Applicant respectfully submits that a *prima facie* case of obviousness of claim 76 is not established, for reasons including those presented above in connection with claim 54.

Claims 81-88, 93-94 and 97-99 are directly or indirectly dependent upon claim 76. Applicant therefore respectfully submits that these claims are allowable due to their dependencies, as well as the additional subject-matter that each of these claims recites.

Independent claim 100 recites a system for heat-treating a workpiece, the system comprising:

- a) means for pre-heating the workpiece to an intermediate temperature; and
- b) means for heating a surface of the workpiece to a desired temperature greater than the intermediate temperature, comprising means for commencing the heating substantially immediately when the workpiece reaches the intermediate temperature.

Applicant respectfully submits that a *prima facie* case of obviousness of claim 100 is not established, for reasons including those presented above in connection with claim 54.

Claim 104 is directly dependent upon claim 100. Applicant therefore respectfully submits that this claim is allowable due to its dependency, as well as the additional subject-matter that it recites.

By the present amendment, independent claim 105 has been amended to recite a semiconductor heating apparatus, comprising:

- a first heating source for heating a first surface of a semiconductor wafer to heat the wafer to an intermediate temperature;

- a second heating source for heating an entire second surface of the semiconductor wafer within a time period less than a thermal conduction time of the wafer, to heat the second surface to a desired temperature greater than the intermediate temperature;
- and

- a first cooled window disposed between the first heating source and the semiconductor wafer.

Applicant respectfully submits that a *prima facie* case of obviousness of claim 105 is not established, for reasons including those presented above in connection with claim 1.

Claims 106-116 and 118 are directly or indirectly dependent upon claim 105. Applicant therefore respectfully submits that these claims are allowable due to their dependencies, as well as the additional subject-matter that each of these claims recites.

**35 U.S.C. § 103(a), claims 21, 44, 67-68 and 91-92**

The Examiner has expressed the view that claims 21, 44, 67-68 and 91-92 are unpatentable over Noguchi in view of Camm and Gat, and further in view of U.S. Patent No. 6,303,411 to Camm et al. ("Camm et al.").

Applicant respectfully notes that Camm et al. issued on October 16, 2001, whereas the present application was filed on December 4, 2001 as a continuation-in-part of application serial no. 09/729,747 filed Dec. 4, 2000. Accordingly, Camm et al. is not citable prior art under 35 U.S.C. § 102(b), and Applicant therefore assumes that the Examiner has viewed the Camm et al. reference as qualifying as prior art pursuant to 35 U.S.C. § 102(e).

35 U.S.C. § 103(c) provides:

- (c) Subject matter developed by another person, which qualifies as prior art only under one or more of subsections (e), (f), and (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

Applicant encloses herewith a statement pursuant to 35 U.S.C. § 103(c) and M.P.E.P. § 706.02(l)(2), confirming that the Camm et al. reference and the present application were, at the time the invention claimed in the present application was made, owned by or subject to an obligation of assignment to the same person, namely, Vortek Industries Ltd. Accordingly, the Camm et al. reference is not citable for obviousness under 35 U.S.C. § 103. Applicant therefore respectfully submits that the rejection of claims 21, 44, 67-68 and 91-92 is overcome.

Applicant also notes that claim 21 is directly dependent upon independent claim 1, claim 44 is directly dependent upon claim 25, claims 67-68 are directly dependent upon independent claim 54, and claims 91-92 are directly dependent upon independent claim 76. As claims 1, 25, 54 and 76 have been shown to be allowable earlier herein, Applicant respectfully submits that

claims 21, 44, 67-68 and 91-92 are allowable due to their dependencies, as well as the additional subject-matter each of these claims recites.

**35 U.S.C. § 103(a)**

The Examiner has expressed the view that claims 23, 70 and 95 are unpatentable over Noguchi in view of U.S. Patent No. 4,151,008 to Kirkpatrick ("Kirkpatrick").

Claims 23, 70 and 95 are directly or indirectly dependent upon claims 1, 54 and 76, respectively. In view of Applicant's foregoing submissions that independent claims 1, 54 and 76 are allowable, Applicant respectfully submits that claims 23, 70 and 95 are allowable due to their dependencies, as well as the additional subject-matter that each of these claims recites.

**Election / Restrictions**

The Examiner has indicated that claims 66, 71, 89, 90, 96, 117, 119 and 120 are withdrawn from consideration, in view of the previous restriction requirement and applicant's election with traverse of the remaining claims. The Examiner has made the restriction requirement final.

Claims 66 and 71 are indirectly dependent upon elected independent claim 54. Claims 89, 90 and 96 are directly or indirectly dependent upon elected independent claim 76. Claims 117, 119 and 120 are directly or indirectly dependent upon elected independent claim 105. In view of the fact that elected independent claims 54, 76 and 105 have been shown to be allowable under the previous headings, Applicant respectfully requests that their dependent claims 66, 71, 89, 90, 96, 117, 119 and 120 be rejoined in this application and allowed, pursuant to 37 C.F.R. § 1.141.

**Fees**

By the present amendment, claims 17 and 40 have been cancelled, and new claims 121 and 122 have been added. Thus, the present application contains one additional independent claim beyond those previously paid for, and the

same total number of claims as previously paid for. Applicant encloses a check in the amount of \$98.00, as payment of the required small entity fee for one additional excess independent claim with a one month extension of time.

**Allowable Subject-Matter**

The Examiner has objected to claims 55-58, 77-80 and 101-103 as being dependent upon a rejected base claim, but has indicated that these claims would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicant respectfully submits that the base claims from which these claims depend, namely, claims 54, 76 and 100, have been shown to be allowable. Accordingly, Applicant has not amended claims 55-58, 77-80 and 101-103 at this time.

**New Claims 121-122**

By the present amendment, new claims 121-122 have been added. Support for new claims 121-122 may be found in Applicant's specification as originally filed, at page 31, line 4 to page 32, line 12, for example.

**Notification of Co-pending Applications**

Applicant assumes that the Examiner is aware of the existence of co-pending commonly-owned U.S. patent application serial no. 10/427,094 filed April 30, 2003, which is a divisional application of application serial no. 09/729,747 filed Dec. 4, 2000 (now U.S. Patent No. 6,594,446), which in turn is the parent of the present continuation-in-part application. Applicant notes that the present Examiner is also the Examiner of the above-noted divisional application serial no. 10/427,094 and was the Examiner of the above-noted parent patent No. 6,594,446.

In relation to new claims 121-122, Applicant also wishes to inform the Examiner of the existence of co-pending commonly-owned U.S. patent application serial no. 10/777,995 filed February 12, 2004.

**Conclusion**

In view of the foregoing, Applicant respectfully submits that the present application is now in condition for allowance, and respectfully requests that a Notice of Allowance be issued. Should the Examiner have any outstanding concerns, the Examiner is respectfully requested to telephone the undersigned agent, to expedite the prosecution of this application.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON &  
BEAR, LLP

Dated: June 14, 2004

By: Che S. Chereskin  
Che Swyden Chereskin, Ph.D.  
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Encl.: Check for \$98.00 for excess independent claim  
Statement Pursuant to 35 U.S.C. § 103(c) and M.P.E.P. § 706.02(l)(2)



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**IN RE APPLICATION**

|                 |   |
|-----------------|---|
| Serial Number:  | 10/005,186  |
| Group Art Unit: | 3742  |
| Examiner:       | Shawntina T. Fuqua                                      |
| Title:          | Heat-Treating Methods and Systems                       |
| Filing Date:    | December 4, 2001 (CIP of 09/729,747 filed Dec. 4, 2000) |
| Inventors:      | CAMM, David Malcolm; ELLIOTT, J. Kiefer                 |
| Agent's ref:    | FETHE24.001CP1 (47753-5CIP)                             |

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June 14, 2004


U.S. Commissioner of Patents and Trademarks  
U.S. Patent and Trademark Office  
Washington, D.C. 20231  
United States

Dear Sir:

**STATEMENT PURSUANT TO 35 U.S.C. § 103(C)  
AND M.P.E.P. § 706.02(L)(2)**

The present application (serial no. 10/005,186) and United States Patent No. 6,303,411 to Camm et al. were, at the time the invention of the present application was made, owned by, or subject to an obligation of assignment to, the same person, namely, Vortek Industries Ltd.

Respectfully submitted,

  
Chen S. Chereskin